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name *Cephalopoda* indicates. On page 191 it is stated that "nearly all the Chordata are marked by the presence, either in embryonic or larval stages only, or else persisting throughout life, of a number of slits or clefts in the walls of the pharynx which serve for breathing, and which are called gill-slits." Do not *all* Chordata have gill-clefts at some stage of their life history? Again, on page 201 one reads the too inclusive statement that "all batrachians breathe by means of gills for a longer or shorter time after birth." On page 256, hyenas are classified as *Felidae*. On page 337 we are informed that muscles are the active organs of motion and locomotion in all animals.

In the physiological section there is an obvious attempt to "write down" to the audience and the result is frequently anything but happy. For instance one meets not infrequently with such apparently significant though actually meaningless statements as (p. 291) "the most necessary element in all the world is oxygen." On page 294 one encounters the rather astonishing bit of information that "muscle is largely a compound of sulphur and other elements." On page 316 we read that "it is the function of hæmoglobin to carry oxygen to the tissues and carbon dioxide from the tissues," a statement which, to say the least, is misleading, in that as regards carbon dioxide, the carrying power of hæmoglobin is at most of minor importance. On page 340 heart muscle is classified as non-striated. On page 291 we encounter the obscure and in part erroneous statement that "carbohydrates contain carbon, hydrogen and oxygen, the former predominating. Fats contain also chiefly oxygen, carbon and hydrogen, the latter predominating." On page 296 under "Tests for Proteids" what is probably the most universal and certain test of all, the biuret reaction, is omitted. On page 301 referring to alcohol we find this remarkable piece of information—remarkable both in point of fact and of rhetorical climax—"unlike other poisons its use establishes a craving or appetite for it which eventually

weakens the will and is apt to lead to intoxication." How *unlike* cocaine, opium, morphine, etc., is it in this cumulative effect? On page 311 we learn that "the mesentery is fastened at the back to the spinal column." On page 363 instead of using axon and axis cylinder as synonymous terms the axis cylinder is spoken of as a central fiber of the axon. On page 317 the term *fibrin* is misused.

A careful reading of the text discloses a considerable number of little inaccuracies, mainly in the way of too inclusive statements, but space will not permit of specific citation. Some of these may perhaps be excusable on the basis of being well-nigh unavoidable in an elementary book where confusion of ideas must be avoided, but in not a few instances a single qualifying word would have set the matter right.

While the reviewer has found it necessary to devote most of his space to pointing out errors, he does not wish to leave the impression that the book is without merit. On the contrary, it has many excellencies. The subject-matter is well chosen, the general descriptive treatment is for the most part excellent and interestingly written and the text covers a wide range of timely topics in addition to the more formal zoological work.

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A FEW BOOKS ON AERONAUTICS

A NEW science and a new industry, a new sport and a new mode of warfare have come upon us with such startling suddenness that many are clamoring to know how it all came about; while authors are tumbling over each other—many over the facts and even over their English too—in a mad rush to tell the story, the story of aeronautics that only a master can tell.

The following are a few of the 1911 versions of this story.

Aerial Locomotion. By E. H. HARPER and ALLEN FERGUSON. Cambridge University Press, XII., 164, price 1 shilling.

This little book is so clearly written that it

can be understood by the average boy, and yet it explains many facts that often are either wholly ignored or, for the average reader, told only in unintelligible symbols and signs.

For the non-mathematical reader, and for the man who does not care for a large volume on the subject, this probably is one of the best books available.

The Aeroplane. By T. O'B. HUBBARD, J. H. LEDEBOER and C. C. TURNER. Longmans, Green and Co., X., 127, price 2 shillings 6 pence.

There is an old proverb to the effect that "too many cooks spoil the broth," and it seems to be eminently applicable in the present case.

The first chapter deals with the properties of the air, and is so full of errors that it would take another chapter to correct them. A simple example will suffice:

Now the density of water-vapor is 0.623 of that of air, and since air can contain a portion of water-vapor amounting to 3 per cent. of its volume, it is obvious that saturated air is lighter than dry air.

This statement would be pretty hard to beat in a contest for number of errors in a single sentence. One had as well say that since a sponge can contain water that therefore a saturated sponge is lighter than a dry one.

As a matter of fact moist air is lighter than dry air at the same temperature and pressure, but the authors have not explained the correct reason.

The rest of the book, after the first chapter, is fairly good for the popular reader and has the excellent feature of conspicuous division into topics, but it is marred here and there by the presentation of rough approximations in the guise of exact values.

Bird Flight as the Basis of Aviation. By OTTO LILIENTHAL. Longmans, Green and Co., XXIV., 142.

This of course is a translation of an old and well-known German book. But the translation was worth while, since it enables a larger number of persons to read for themselves Lilienthal's accounts of numerous ex-

periments based upon careful studies of birds and their mode of flight. It is astonishing how many experiments he and his brother made, and what generally well-founded conclusions they reached. Otto Lilienthal was one of the enthusiastic pioneers in the experimental study of aviation and his work undoubtedly contributed materially to the final accomplishment of mechanical flight, albeit along lines different from those he believed the most practicable. He believed that nature's method is always the best method—forgetting, possibly, that the locomotive, though swifter than the greyhound, runs on wheels and not on legs—and so he strove to fly, as do the birds, with beating wings and soaring.

Soaring, at least, is greatly to be desired, and likely some day to be fully achieved, and so this book, by one of the most enthusiastic advocates of bird flight, still has a freshness about it and much of interest; in fact it is one of the few aviation classics.

Monoplanes and Biplanes. By G. C. LOENING. Munn and Co., New York, XIV., 331, price \$2.50.

This book is not adapted to the taste of the general reader—it is neither poetry nor romance—but to the man who is seriously studying aeronautics and needs to know how the various types of aeroplanes are made it is well nigh invaluable.

It begins with a short but appreciative account of the work of Langley, Lilienthal and Chanute. This is followed by several excellent chapters on air resistances and air friction, with numerical examples applicable to aeroplane designing.

After this, various types of aeroplanes, 18 monoplanes and 20 biplanes, are described in detail and intercompared. A separate chapter is devoted to the different types of controlling apparatus, and another timely and sensible chapter, to accidents and their various causes.

Every chapter is profusely illustrated, and in the great majority of cases the illustrations are extremely helpful to the reader. There also are numerous references to original articles which may be consulted by those who wish more detailed information.

In a new edition pages 18, 19 and 20, in so far as they discuss air density, might be slightly modified to advantage. Here "air holes" are spoken of as places of low air density.

An aeroplane entering one of these low density regions from the air of higher density around it, will suddenly fall without any warning, merely because the pressure has enormously decreased, and the aeroplane has not had time to attain the requisite velocity of support in this lighter medium.

Enormous differences in pressure must cause enormous changes in the barometer, but such sudden changes are never found in the open, and, besides, it can be shown that the movement (whirl) of the atmosphere necessary to produce a change of pressure amounting to one tenth of the total would be of most destructive violence.

But this is a small fault to find with a book so generally helpful.

Elementary Aeronautics. By ALBERT P. THURSTON. Whittaker and Co., 126.

This is a non-mathematical but clearly written account of the action of air upon moving surfaces, plane and curved, and the application of these principles in the design and operation of aeroplanes.

While both elementary and brief, it seems to be free from errors, and can be recommended to those who wish some reliable information about the general action of aeroplanes, but have not the time to make a real study of them.

W. J. HUMPHREYS

A Manual of Philippine Silk Culture. By CHARLES S. BANKS, Department of the Interior, Bureau of Science, Manila, 1911.

Mr. Banks has been engaged, among his other duties, in a study of the possibilities in the way of profitable silk culture in the Philippines ever since the Bureau of Science was started, and this manual puts into convenient shape the results of his investigations. It is a royal octavo pamphlet of about fifty pages, with 18 good halftone plates and diagrams of rearing house and reel. He gives directions for the care of the domestic mulberry silkworm, and announces a cross between the Ben-

gal-Ceylon and Japanese silkworms which he terms "the Philippine race of silkworms." He also announces the successful introduction of the Eri or Castor silkworm (*Attacus ricini* Boisd.) from Ceylon. He thinks that the silk produced from this insect will be popular not only among the Christian Filipinos, but also among the mountain tribes and the Moros, and further that it will find a sale among the Americans and Europeans for hangings, upholstery and even for heavy dress goods. He concludes that, with both the mulberry and the Eri silkworms, the industry can be carried on in the Philippines under conditions as favorable as those which obtain in the best silk-producing countries in the world, with the added advantage that no disease has appeared as yet. That every effort is being made to prevent the introduction of disease is shown by the act of August 14, 1907, prohibiting the importation of silkworms, either eggs or cocoons, into the Philippine Islands except by the Bureau of Science.

L. O. H.

SPECIAL ARTICLES

FOSSIL HOLOTHURIANS

Few classes of animals have a less satisfactory geological record than the holothurians and every fragment that can be gathered is therefore of unusual interest and importance. The known records occur in two forms, impressions of the whole animal or much more commonly, nearly or quite microscopic calcareous particles imbedded in fine shales and limestones and resembling more or less nearly the similar calcareous particles found in the body-wall of most living holothurians. Ludwig¹ has well summed up the phylogenetic value of these fossil particles:

Solche Reste aus dem Kohlenkalk, dem Jura, der Kreide und dem Tertiär vorliegen, aber keine sichere Bestimmung nach Art, Gattung und Familie gestatten: nur die eocänen Synaptidenreste . . . machen davon eine Ausnahme, da sie sich mit einiger Sicherheit auf die Gattungen Synapta, Chiridota (oder Trochodota) und Myriotrochus beziehen lassen.

¹ 1892, "Die Seewalzen," p. 446.